



General

Guideline Title

Management of isolated fractures of the atlas in adults. In: Guidelines for the management of acute cervical spine and spinal cord injuries.

Bibliographic Source(s)

Ryken TC, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, Rozzelle CJ, Theodore N, Walters BC, Hadley MN. Management of isolated fractures of the atlas in adults. In: Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery. 2013 Mar;72(Suppl 2):127-31. [24 references] [PubMed](#)

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

The rating schemes used for the strength of the evidence (Class I-III) and the levels of recommendations (Level I-III) are defined at the end of the "Major Recommendations" field.

Recommendations

Level III

- Treatment of isolated fractures of the atlas based on the specific atlas fracture type and the integrity of the transverse atlantal ligament is recommended.
- For an isolated fracture of the atlas with an intact transverse atlantal ligament, cervical immobilization is recommended.
- For isolated fractures of the atlas with disruption of the transverse atlantal ligament, either cervical immobilization alone or surgical fixation and fusion is recommended.

Summary

No Class I or Class II medical evidence addressing the management of patients with isolated atlas fractures was identified. Class III medical evidence on this topic from case series and case reports supports several treatment strategies for patients with acute isolated fractures of the atlas. One study addressing quality-of-life issues has been published.

Nondisplaced isolated anterior or posterior atlas arch fractures and fractures of the atlas lateral mass (Types I and III) have been effectively treated with external cervical immobilization devices. Rigid collars, suboccipital mandibular immobilizer braces, and halo ring-vest orthoses used for

8 to 12 weeks have been described with successful union/healing rates >96%. There is no medical evidence suggesting the superiority of 1 form of external immobilization over another.

Combined anterior and posterior arch fractures of the atlas (Type II or burst fractures) with an intact transverse atlantal ligament (stable) have been effectively managed with use of a rigid collar, a suboccipital mandibular immobilizer brace, or a halo orthosis for a duration of 10 to 12 weeks.

Combined anterior and posterior arch fractures of the atlas (Type II or burst fractures) with evidence of transverse atlantal ligament disruption (unstable) have been effectively treated with either rigid immobilization alone (halo orthosis) for a period of 12 weeks or surgical stabilization and fusion. Consideration of the potential complications of halo immobilization, particularly in the elderly, is suggested and must be balanced against the potential morbidity/mortality associated with surgical treatment for these fracture injuries.

Criteria proposed to determine transverse atlantal ligament injury with associated C1-C2 instability include the sum of the displacement of the lateral masses of C1 on C2 of >6 to 9 mm on a plain open-mouth x-ray (or 8.1 mm, the rule of Spence corrected for magnification), a predental space of >5 mm in adults, and evidence of transverse atlantal ligament disruption or avulsion on magnetic resonance imaging (MRI).

Definitions:

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question^a

Class	Therapeutic Studies: Investigating the Results of Treatment	Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging Results, and Classifications
I	High-quality randomized controlled trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a \bar{A} , statistic ≥ 0.60 or an intraclass correlation coefficient of ≥ 0.70
	Systematic review ^b of Class I randomized controlled trials (and study results were homogeneous ^c)	Systematic review ^b of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a \bar{A} , statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective ^d comparative study ^e	Systematic review ^b of Class II studies	
	Systematic review ^b of Class II studies or Class I studies with inconsistent results	Study of nonconsecutive patients; without consistently applied reference "gold" standard	
	Case-control study ^g	Systematic review ^b of Class III studies	
	Retrospective ^f comparative study ^e	Case-control study	
	Systematic review ^b of Class II studies		
III	Case series ^h	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a \bar{A} , statistic of <0.40 or an intraclass correlation coefficient of <0.50

Class	Expert opinion Therapeutic Studies: Investigating the Results of Treatment	Expert opinion Diagnostic Studies: Investigating a Diagnostic Test	Clinical Assessment: Studies of Reliability and Validity of Observations, Including Clinical Examination, Imaging, Rest studies, and Classifications
^a	A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design		

^bA combination of results from 2 or more prior studies.

^cStudies provided consistent results.

^dStudy was started before the first patient enrolled.

^ePatients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

^fThe study was started after the first patient was enrolled.

^gPatients identified for the study on the basis of their outcome, called "cases" (e.g., failed fusion), are compared with those who did not have outcome, called "controls" (e.g., successful fusion).

^hPatients treated 1 way with no comparison group of patients treated in another way.

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
Level II	Recommendations for patient management which reflect moderate clinical certainty (usually this requires Class II evidence or a strong consensus of Class III evidence)
Level III	Other strategies for patient management for which the clinical utility is uncertain (inconclusive or conflicting evidence or opinion)

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Isolated fractures of the atlas

Guideline Category

Management

Treatment

Clinical Specialty

Neurological Surgery

Orthopedic Surgery

Intended Users

Advanced Practice Nurses

Hospitals

Nurses

Physician Assistants

Physicians

Guideline Objective(s)

To identify additional medical evidence on the management of isolated fractures of the atlas since the initial 2002 guideline publication

Target Population

Adult patients with isolated fractures of the atlas

Interventions and Practices Considered

1. Treatment based on fracture type
2. Use of external cervical immobilization devices
3. Surgical stabilization and fusion

Major Outcomes Considered

- Successful union/healing rates
- Quality of life
- Complications of treatment

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Search Criteria

A National Library of Medicine (PubMed) computerized literature search from 1966 to 2011 was undertaken using Medical Subject Headings in combination with "vertebral fracture": atlas and human. This strategy yielded 582 references. The abstracts were reviewed, and articles addressing clinical management and follow-up of atlas fractures were selected for inclusion. The relative infrequency of these fractures, the small number of case series, and the numerous case reports with pertinent information required rather broad inclusion and exclusion criteria. The bibliographies of the selected articles were reviewed to provide additional references and to assess completeness of the literature review.

These efforts resulted in 5 contemporary articles describing acute traumatic atlas fractures not included in the previous version of this guideline.

One of these reports provided no new data and was excluded. Although case reports were included in the previous guideline because of the paucity of clinical material on this subject, no new case reports were identified that would affect the previous recommendations.

Number of Source Documents

Fourteen contemporary Class III medical evidence case series are summarized in Evidentiary Table format (refer to Table 2 in the original guideline document).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Rating Scheme for the Strength of the Evidence: Modified North American Spine Society Schema to Conform to Neurosurgical Criteria as Previously Published and for Ease of Understanding and Implementation: Levels of Evidence for Primary Research Question^a

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	Systematic review ^b of Class I randomized controlled trials (and study results were homogeneous ^c)	Systematic review ^b of Class I studies	
II	Lesser-quality randomized controlled trial (e.g., <80% follow-up, no blinding, or improper randomization)	Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard)	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a \bar{A} , statistic of 0.40–0.60 or an intraclass correlation coefficient of 0.50–0.70
	Prospective ^d comparative study ^e	Systematic review ^b of Class II studies	
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III	Case series ^h	Poor reference standard	Evidence provided by 1 or more well-designed clinical studies in which interobserver and intraobserver reliability is represented by a \bar{A} , statistic of <0.40 or an intraclass correlation coefficient of <0.50

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^aA complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.

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^dStudy was started before the first patient enrolled.

^ePatients treated 1 way (e.g., halo vest orthosis) compared with a group of patients treated in another way (e.g., internal fixation) at the same institution.

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^hPatients treated 1 way with no comparison group of patients treated in another way.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Selected articles were carefully reviewed by the authors. An evidentiary table was created (refer to Table 2 in the original guideline document) that reflected the strengths and weaknesses of each article.

On occasion, the assessed quality of the study design was so contentious and the conclusions so uncertain that the guideline authors assigned a lower medical evidence classification than might have been expected without such a detailed review. In every way, adherence to the Institute of Medicine's criteria for searching, assembling, evaluating, and weighing the available medical evidence and linking it to the strength of the recommendations presented in this document was carried out.

Articles that did not achieve immediate consensus among the author group were discussed extensively until a consensus was reached. Very few contributions required extensive discussion. Most articles were easily designated as containing Class I, II, or III medical evidence using the criteria set forth by the author group at the initiation of the literature evaluation process (see the "Rating Scheme for the Strength of the Evidence" field).

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The current author group was selected for its expertise in spinal surgery (both neurosurgical and orthopedic), neurotrauma, clinical epidemiology, and, in several cases, prior experience with guideline development. The topics chosen for inclusion in this iteration of these guidelines are contemporary and pertinent to the assessment, evaluation, care, and treatment of patients with acute cervical spine and/or spinal cord injuries.

Rating Scheme for the Strength of the Recommendations

Levels of Recommendation

Level I	Generally accepted principles for patient management, which reflect a high degree of clinical certainty (usually this requires Class I evidence which directly addresses the clinical questions or overwhelming Class II evidence when circumstances preclude randomized clinical trials)
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Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field). All supporting evidence was Class III.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate management of isolated fractures of the atlas in adults

Potential Harms

- Prolonged (halo) immobilization is associated with discomfort.
- In one study involving elderly patients, halo ring and vest complications included respiratory distress, dysphagia, and pin-related complications.
- Consideration of the potential complications of halo immobilization, particularly in the elderly, is suggested and must be balanced against the potential morbidity/mortality associated with surgical treatment for these fracture injuries.

Qualifying Statements

Qualifying Statements

- Medical evidence-based guidelines are not meant to be restrictive or to limit a clinician's practice. They chronicle multiple successful treatment options (for example) and stratify the more successful and the less successful strategies based on scientific merit. They are not absolute, "must be followed" rules. This process may identify the most valid and reliable imaging strategy for a given injury, for example, but because of regional or institutional resources, or patient co-morbidity, that particular imaging strategy may not be possible for a patient with that injury. Alternative acceptable imaging options may be more practical or applicable in this hypothetical circumstance.
- Guidelines documents are not tools to be used by external agencies to measure or control the care provided by clinicians. They are not medical-legal instruments or a "set of certainties" that must be followed in the assessment or treatment of the individual pathology in the individual patients we treat. While a powerful and comprehensive resource tool, guidelines and the recommendations contained therein do not necessarily represent "the answer" for the medical and surgical dilemmas faced with many patients.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Mobile Device Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2013 Mar

Guideline Developer(s)

American Association of Neurological Surgeons - Medical Specialty Society

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

Congress of Neurological Surgeons

Guideline Committee

Guidelines Author Group of the Joint Section of Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices described in this guideline.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) and EPUB for eBook devices from the [Neurosurgery Web site](#)

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Availability of Companion Documents

The following are available:

- Foreword. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):1. Electronic copies: Available in Portable Document Format (PDF) from the [Neurosurgery Web site](#) .

- Commentary. Guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):2-3. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .
- Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):5-16. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .
- Methodology of the guidelines for management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(3):17-21. Electronic copies: Available in PDF from the [Neurosurgery Web site](#) .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on July 9, 2013. The information was verified by the guideline developer on October 3, 2013.

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